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BARK SCRAPING AND BARK AFFECTIONS.

By A. Sharples.

An interesting point in relation to bark disease on rubber is that the "canker" caused by Phytopthora Faberi is unknown in Malaya while many estates in Java and Ceylon suffer severely owing to this fungus causing the death of the bark over the tapping areas. A constant watch is being kept for any definite outbreak of "Phytopthora" canker in Malaya; any tree suffering from bark disease is examined in situ if the symptoms as described to us, resemble those of "Phytopthora" canker.

The first definite bark affection in Malaya, where a sufficiently large number of trees was attacked as to necessitate immediate attention, was observed recently. The symptoms did not correspond in any respect to those given for "Phytopthora" canker. These trees showed a slow rotting of the bark. Over the dead bark numerous saprophytic fungi were growing. The bark appeared waterlogged and as the rotting proceeded slowly inward, borers became active and entered the wood; the final result was that the tree had to be taken out to prevent further depredations by borers.

Enquiries showed that before tapping, the bark* was scraped to such an extent that the green cork cambium was removed. The manager was applying Prof. Fickendy's patent method for obtaining an increase in yield of latex. This method is performed by scraping away the outer corky layers down to the green cork-cambium, but leaving the latter intact. Such treatment presumably irritates the tree, increases wound-response, and the result should be an increased flow of latex.

* The term "bark" is commonly used by planters to include all tissues external to the wood and bast-forming cambium. It is used in this sense in this article.

When inspecting the diseased trees it appeared that the bark-scraping was the fundamental cause of the trouble. The explanation was unsatisfactory in the absence of experimental data, so an experiment was started to test the effect of bark scraping upon rubber trees, with a view to elucidate whether such treatment makes the trees more liable to attack from fungi and insects.

For the experiment thirty well-grown trees, 5 years old, untapped, were taken. They were divided into 5 blocks, each containing 6 trees: The blocks were marked 1A, 1B, 1C, 2A, 2B. Block 1C acted as control to blocks 1A and 1B. The treated trees were scraped on 28/5/15 over half their circumference to a height of 4 feet from the ground. Care was taken that the laticiferous layer was unharmed, no latex extruding after the scraping.

Block 1A:—Scraped heavily, the green cork-cambium being removed. The scraped area was watered once daily with a hand pump, for a few minutes.

Block 1B:—Trees scraped lightly, the green cork-cambium being left intact. Watered as 1A.

Block 1C:—Unscraped, but water applied as in 1A and 1B.

Block 2A:—Scraped as 1A, but no water applied over scraped area.

Block 2B:—Scraped as 1B, but not watered.

Blocks 1A, 1B and 1C were treated with water daily in order to prevent a spell of dry weather interfering with the progress of the experiment. The results of the treatment are most interesting. A daily examination of the trees was made, the dates given below indicating the day upon which the attacked trees were first noticed.

Examined 1/6/15—Block 1A, showed one tree badly attacked by boring beetles, the latex streaming down to the bark. The remaining five trees in this block also showed attempts on the part of the insects to pierce the bark. None of the trees in the other blocks showed signs of attack.

Examined 6/6/15—One tree in Block 2A very badly attacked by borer.

Examined 11/6/15—One tree in Block 1B attacked by borers; another tree in Block 2A, showed signs of a bursting of the bark, from which latex was extruding.

Examined 14/6/15—A third tree in No. 2A showed signs of the bark bursting, with extrusion of latex.

From the 28/5/15 to 2/6/15, there was no rain: after the 2/6/15, daily showers were the rule.

Thus, out of 24 treated trees, 5 were attacked as a result of the bark scraping. Of these four were heavily scraped and only one lightly scraped. The control trees in Block 1C, and the remaining untreated trees in the surrounding area were unaffected.

The trees were attacked in two different ways. The tree in Block 1A, that in Block 1B, and one in Block 2A, suffered from a direct attack from boring beetles. The bark of the remaining two trees affected in Block 2A were attacked by a fungus, which progressed rapidly in one case, killing the bark over a large area, but in the other only small areas of bark were attacked and this tree now shows signs of recovery. These trees were not attacked by borers. The unscraped areas of the attacked trees were never affected.

A striking feature was the rapidity of the attack, borers being active on the first affected tree within four days. The fifth affected tree was noticed 17 days after the beginning of the experiment.

The results show that removal of the outer corky layers increases the suspectibility of the trees to attack by fungi and insects. They show also that if the green cork-cambium is left intact, the susceptibility to attack is much less than it is when this layer is scraped away. This experiment indicates that the corky integument is the important protective layer. It has been customary to regard the laticiferous layer as a protection against direct attacks from boring beetles, but this idea must now be abandoned. The activity of the borers on the trees in Block 1A and 2A, within a week of scraping the bark caused exudation of the latex in streams down the scraped areas. Dozens of beetles were caught in the streaming latex but this did not prevent others getting through the bark into the wood. It may be emphasised here, that the experimental plot is clear of timber, is planted 24 x 12, and more or less isolated from the rest of the plantations, so that conditions do not favour the borers. The rapid nature of the attack prevents the assumption of fungi preceding and killing the tissue in advance of the borers. Other cases of bored trees have been noticed with latex streaming down the bark. The laticiferous layer must still be alive at the time of the attack but it does not prevent the entrance of the insects. If the outer corky protective layer of a rubber tree is removed or injured, the latter is liable to a direct attack from boring beetles.

The selective nature of the borer attack was a noticeable feature. On Block 1A, two days after scraping, signs of borers could be observed on every tree. Later the insects appeared to concentrate upon one tree, which was vigorously attacked. Such selection is

difficult to explain but is probably associated with the fact, that plantation conditions are fundamentally unhealthy. Our conception of a healthy tree is limited by a spreading crown of leaves and roots apparently unattacked by disease. This gives no indication of one tree being more susceptible to disease than another, but such is the case. Under forest conditions the struggle for existence operates in a drastic manner, and susceptible individuals seldom enter into the competition. Plantation conditions considerably modify the struggle, and there must be large numbers of apparently healthy trees surviving which under natural conditions could never reach maturity. Such trees would be most liable to attack from fungi and insects.

During tapping operations the inner cortical tissues are opened up. In this connection, the danger of bark affections similar to those observed in the experiment is slight. There is a considerable difference between exposing outer cortical tissues by scraping and inner cortical tissues by paring, as in tapping. When tapping, the tissues down to the wood and bast forming cambium are removed, and only very narrow strips of an actively dividing layer are exposed at any one time. The coagulated latex along the tapping cuts protects these exposed strips to some extent, while the actively dividing cambium quickly cuts off layers of cells, one of which takes on the functions of a cork-forming cambium and the protective layer is soon replaced .

Heavy scraping of the bark *i.e.* removal of the cork-cambium, exposes the outer, old, cortical cells. It is possible that in such tissues, a cork-cambial layer does not form very readily, so that the outer cortical cells are exposed to the atmosphere for a comparatively long period. If this coincides with a period of wet weather, the exposed cells become waterlogged, and their activities interfered with. As a result, numerous ordinarily saprophytic fungi flourish on the exterior and gradually grow inwards, rotting the bark from the outside, inwards. Undoubtedly, such is the method of attack in cases where there is not a direct attack by borers. The same applies to trees scraped so as to leave the cork forming cambium intact. Such trees are not readily attacked, owing to the active cork-cambium quickly cutting off cork cells to the outside, forming a new protective layer. This rapid formation of cork prevents waterlogging of the cells and the danger of attack is considerably lessened thereby. But if the cork-cambium cells by any chance become waterlogged, their activities are interfered with and in such a case the bark is as liable to attack as that of the heavily scraped trees.

Fickendy, in his application for patent rights, says that "the bark should be scraped down to the cork-forming cambium leaving the latter intact." The experimental results show that trees carefully treated as above may be attacked by borers and fungi, but that the susceptibility is enormously increased if the cork-cambium is removed. The scraping of the bark so as to leave the cork-cambium intact, without exposing the outer cortical tissues, is a practical impossibility under estate conditions. This layer is not above $\frac{1}{100}$ inch in thickness, and as the scraping would have to be performed by coolies, there is not the slightest doubt that large patches of the cork-forming layers would be removed. Such trees are comparable to the heavily scraped trees in the experiment. It must be emphasised that $33\frac{1}{2}\%$ (4 out of 12) of the heavily scraped trees were attacked, and these were growing under conditions comparatively unfavourable for the development and spread of fungi and beetles. Most estates provided much better conditions for the spread of pests, for as stated above the experimental plot consists of fairly wide-planted, untapped, well grown trees and the ground is clear of rotting timber.

It follows that bark-scraping of any description should be carried out with discretion. It is quite easy, with a little care to scrape off the scaly bark on old trees without injury. This is done on large numbers of estates to ensure a clean yield of latex. It has been noticed on several estates that this has been undertaken so carelessly as to expose the outer cortical tissues, thereby laying the trees open to injury. Such carelessness must be severely condemned; estates managers would be well repaid if they inspected scraped trees immediately after the scraping.

To all patent methods of increasing yield of latex, there are serious objections. It is admitted by authorities that it is possible to exhaust a rubber tree by draining it too rapidly of its latex. This conclusion has been reached as a result of practical experience. Unfortunately there is a little positive knowledge as to the function of latex in the economy of the tree, and until we gain some knowledge, it is necessary to urge the desirability of a conservative attitude in connection with methods for artificially increasing yield of latex. The problem to be solved is whether latex is a secondary waste product, the withdrawal of which from the laticiferous vessels does not influence the vital processes or whether it is a primary product, the withdrawal of which means increased activity on the part of the tree, in order immediately to replace that taken away. If the latter, then artificial methods of increasing yield beyond certain limits prejudices the health of the tree, while if it is waste

material, any method of increasing yield might be employed, if the method of extraction, *i.e.* bark removal etc., did not interfere with the normal processes. In estate practice rapid removal of bark, which implies insufficient time for a good renewal, is the limiting factor in the tapping process, not the quantity of latex extracted. The problem stated above is of prime importance for the future of the rubber industry. The investigation of physiological problems has been neglected in the past; partly because of the difficulties which surround investigations of this nature in tropical countries, and partly because more obvious matters demanded immediate attention. It is to be hoped that the line suggested will receive early attention, though many years must elapse before results of practical value are obtained.

NOTES ON SMOKED SHEET AND SMOKE HOUSES.

By B. J. Eaton.

As enquiries are received from time to time from planters, asking for advice on the phenomenon in connection with sheet rubber known on the rubber market as "stretching rusty or resinous" and frequently attributed by brokers to excess of resin in the particular rubber, it is thought advisable to make a brief statement with reference to this particular fault, which, although it probably has no effect on the real quality of the rubber, affects its market value and under present conditions of buying and selling must be taken account of and remedied.

The appearance which is usually produced when the dry rubber is stretched or lightly scratched, resembles powdered resin, hence probably the broker's idea of the presence of excess of resin.

The phenomenon however is due to a sweating or exudation of the serum or mother-liquor left in the rubber, which comes to the surface as the sheet of rubber contracts on drying and, if unable to drain off or not removed by suitable methods, evaporates on the surface in the form of a thin film. This film is not obvious till the rubber is stretched or scratched, when it breaks up and on account of the reflection and refraction of light caused by small particles, its appearance is indicated by a deposit resembling powdered resin. All transparent substances, such as glass, large colourless crystals, light yellow resins, gums, etc., when in a thin film, would not be visible, but when powdered the minute particles all reflect and refract light and the powdered material becomes visible as a white or yellowish powder. The film of evaporated serum on sheet rubber behaves similarly.

Some time last year when investigating surface slime formation on slab rubber, *i.e.* fresh coagulum from the ordinary pans, which were only rolled or pressed lightly and which contained a large proportion of residual serum, a large amount of this deposit was naturally formed on the surface of these slabs; when the slabs were soaked in water, if the surface remained above the surface of the water in the tanks in which the slabs were soaked, this slime formed on the surface on standing, while on the side below the surface of the water it was dissolved off in the water.

An analysis of this slime, after drying completely in a desiccator, yielded nitrogen corresponding to a total protein content of over 60 per cent, the remainder being chiefly resin (acetone extract) and mineral salts. This proved that the film consisted largely of protein material as had been suspected.

Remedy:—The remedy for this fault suggests itself, viz., to allow the sheets, after machining and marking, to drain for an hour or two and then to soak them again in large pans of water, with one or two changes of water, if necessary, subsequently scrubbing the surface of the sheets slightly with a stiff scrubbing brush, after removing from the water, and before placing in the smoke house. As a rule, the more concentrated the latex used in making the sheet, and the thicker the sheet, the more liable is this film to be formed.

This phenomenon is less likely to occur on ribbed sheets, *i.e.* with ribbed markings along the length of the sheet, since on hanging to drain, the exudation from the rubber would drain more easily along the ribs.

A sample was received recently from an estate in which only one side of the sheet was affected. This was probably caused by the sheet having been placed on a table on which the serum from other sheets had drained.

Control of Smoke Room Temperatures.

The usual method of controlling the temperature in a smoke house is by means of a maximum and minimum thermometer.

The disadvantage of this instrument in recording temperatures is that a coolie can easily make up a fire early during the night so that the thermometer reaches a definite maximum and, for the remainder of the night, the fire need not be replenished, since the temperature will not drop very low till early morning. The actual maximum temperature may therefore have been maintained only a very short time and the drying may become slow.

The use of an instrument however which records the temperature automatically during the whole period obviates this difficulty and is an excellent check on the coolie. Such an instrument is known as a thermograph and is supplied by most scientific apparatus makers.

The instrument consists of an eight-day clock rotating a drum to which a paper chart is fixed. The chart is divided into days and hours, each chart covering a period of 8 days. Sufficient charts are provided with the instrument for one year and extra supplies can be purchased cheaply or a plain piece of paper can be used, as the temperature curve will show whether great variation of temperature has occurred. The instrument itself costs under £5; the clock, with chart attached, is enclosed in a copper case, which can be locked, so that the mechanism of the instrument cannot be interfered with. The only work involved, is the winding of the clock once every eight days and the replacement of the old chart by a new chart.

Damp Smoke Houses.

One or two enquiries have been received in connection with the "sweating" of the rubber in smoke houses and the deposition of moisture on the rubber and on the interior of the building.

In these cases, it was found that outside smoking arrangements were employed, *i.e.* furnaces built up outside the smoke room—usually below the ground level, with a flue leading into the smoke room.

In one case, common moulds or mildews were actually found growing on the rubber in the smoke house.

As a rule such exterior smoking arrangements are unsatisfactory. The principle of smoking is slow combustion, producing a product rich in antiseptic constituents; consequently to obtain a good smoke or vapour the fuel must burn slowly and at a comparatively low temperature. Many of the products of this slow combustion, although volatile, are easily condensed, and with an exterior furnace and long flue, these products condense in the flue or near the end entering the smoke room, and the water vapour which passes through, condenses in the smoke room itself, on the rubber and on the walls and roof of the room and causes "sweating" or deposition of moisture. Where the fuel is burnt in the smoke house itself, in boxes or holes in the ground, there is sufficient heat to drive the water vapour out and only the other products are left to diffuse into the rubber.

One factor in connection with smoking which is frequently not realised, is that the drying caused by the heat is far more

effective than the actual smoke products—creosote, etc.—as a preventative of moulds.

This is well known in connection with the smoking of bacon and meat in general.

It has been actually stated by scientific workers, that, where moulds appear on smoked sheet, the rubber could not have been properly smoked. This is entirely erroneous. The common mildews will grow most readily on the best smoked sheet, given the proper conditions subsequently *i.e.* suitable moisture conditions.

One of the simplest methods of inducing mould growth on smoked sheet is to wrap the sheet in paper—especially newspaper.

Several cases have occurred also in which No. 1 pale crepe and smoked sheets have been despatched by an estate manager in a perfect condition, and owing to becoming damp in the hold of a ship or by subsequent accidental contact with sea water, moulds of various kinds have developed and discoloured the rubber and the manager has been blamed wrongly. This has been proved by actual instances, in which cases of rubber despatched for the last International Rubber Exhibition, which had previously been inspected by the Director of Agriculture and the writer and found to be in perfect condition, were accidentally dropped into the sea at Port Swettenham and when returned to the Agricultural Department were found to be discoloured by most of the usual fungi which have been found by the mycologist to produce such effects.

THE ILCKEN-DOWN COAGULATION PROCESS.

A DISCLAIMER.

By B. J. Eaton.

With reference to the use of my name in the pamphlet issued by the inventors of this coagulation process, I wish to state that this was done without the sanction of the Director of Agriculture or myself.

The Director is always willing to have any new process in connection with the preparation of rubber investigated, but such reports are only for the use of those interested, and although not in any way confidential, must not be used without authority, for advertisement purposes.

In the second place, in connection with this particular process, one line was extracted from the report, without its context, which gives an entirely erroneous impression. It is impossible, in the

case of rubber, to give any definite opinion on the value of any particular process of coagulation or preparation of rubber, from an examination of one sample only, since the uniformity of the rubber prepared by almost any process, depends on a large number of factors. With one or two possible exceptions, the only advantage which is likely to be possessed by any of the numerous patent processes invented, compared with the use of acetic acid when properly employed, is that of cost of coagulant or cost of method employed. Generally speaking however there are very few satisfactory coagulants which can be recommended in preference to acetic acid on the grounds of economy.

METHODS AND MATERIALS FOR THE CONTROL OF INSECT PESTS.

By P. B. Richards.

PART VII.

Chemical Measures. II. Contact Poisons. *Continued.*

Resin, Rosin.

A large number of substances formed by exudation from plants are grouped under the name Resin. They possess somewhat similar physical characters but vary in chemical constitution. The resin which is used in the preparation of contact insecticides is the residue remaining after the distillation of turpentine obtained from various species of pine. It is known commercially as fir or pine tree rosin, common rosin or colophony. The recipes here given apply only to this type.

Common rosin being insoluble in water, it is impossible to use the substance as such for a contact spray. Rosin is, however, soluble in solutions of caustic potash and caustic soda and of the carbonates of these metals, forming the so-called rosin soaps. In these forms rosin is one of the most efficient of contact insecticides for general purposes.

Rosin Compound.

Rosin compound or "sodium resinate" is the rosin soap obtained by boiling powdered rosin in a solution of sodium hydroxide—caustic soda,—or sodium carbonate—washing soda. For preparation on a small scale, washing soda is the more convenient material, whereas for preparation in bulk for sale, crude caustic soda would be cheaper.

Of the following three recipes, (*a*) and (*b*) are advised for the use of the gardener and planter requiring from ten to four or five hundred gallons of wash, while (*c*) should be used for the preparation of large quantities of stock solution.

Preparation.

(*a*) Stock solution containing 2 lbs. rosin.

Dissolve one pound of washing soda in one gallon of water in a kerosene tin or boiler of four gallons capacity. Heat over a steady fire and when boiling add two pounds of powdered rosin. Continue to heat, stirring the mixture with a wooden paddle. Whenever the mixture froths up add cold water, a little at a time, care being taken not to add so much as to chill the liquid. The mixture is at first somewhat viscous, but as boiling and stirring proceed it becomes thinner, and after fifteen to thirty minutes should become clear and of a deep coffee colour. Pour a little of the mixture into a glass of water. If it forms a clear amber liquid, not milky or cloudy, the wash is ready for removal from the fire. If there is any milkiness, boiling must be continued until the wash answers this test. The mixture will have increased in bulk by the addition of water up to between two and three gallons.

Should the preparation be unduly long in becoming clear, add another ounce of washing soda.

On cooling, the stock solution should remain clear. It will keep indefinitely if stored in a closed vessel.

The stock solution is diluted with water for use at the rate of one pound of rosin to five gallons of spray fluid for a strong wash, or to ten gallons for a wash of normal strength.

By this method one coolie can prepare about five lots per day, providing stock solution sufficient for from fifty to a hundred gallons of spray fluid.

(*b*) Stock solution containing six and fourteen pounds of rosin respectively.

The preparation is essentially similar to that described above, but larger quantities are dealt with at a time, effecting a saving in labour.

A boiler of ten or twenty gallons capacity is required. Six pounds of rosin can conveniently be treated in a ten gallon boiler, and fourteen pounds in one of twenty gallons.

For each two pounds of rosin, dissolve one pound of washing soda in one gallon of water and bring to boiling. Then add the crushed rosin in lots of about two pounds at a time, stirring well between whiles. Continue treating, and whenever the mixture froths up add sufficient cold water to control the frothing, taking

care not to chill the mixture. When the mixture has boiled to a clear dark brown liquid, test it for milkiness by adding a small quantity to a glass of water. If there is no milkiness, a clear liquid like weak coffee resulting, the preparation is complete. Otherwise continue boiling.

Should the mass remain viscous after twenty minutes boiling add a handfull of washing soda.

When the preparation is complete the lot containing six pounds of rosin should bulk between five and six gallons, and that containing fourteen pounds should be from twelve to fourteen gallons. Measure up each quantity as made, and at the end of the day's preparation add water to the whole stock sufficient to bring it up to one gallon for each pound of rosin used. Store for use, preferably in a closed barrel or tank.

Preparations of greater concentration can be made, but with cooly labour it is not advisable as the frothing is more difficult to control. Boiling over is also very likely to take place if it is attempted to make more than six gallons at a time in a ten gallon boiler, or than fourteen gallons in a twenty gallon boiler.

Too great concentration of the stock solution may result in the separating out of some of the rosin soap from the aqueous solution as a yellow pasty mass on cooling. This is to be avoided because the quantity of rosin per gallon of stock solution would be altered and the strength of the wash used would be out of control. Should the soap separate out in this way, a known quantity of water sufficient to redissolve it should be added, and the strength in pounds of rosin per gallon of stock solution re-calculated.

Two coolies with a ten gallon boiler should make five or six lots per day, say thirty to thirty-six gallons. With one twenty gallon boiler four lots would probably represent the day's output—fifty-six gallons. These quantities can be increased by about half if a supply of boiling water is maintained in an auxiliary boiler.

(*c*) Preparation in large quantities with caustic soda.

Rosin consists chiefly of free acids which form a soap in combination with caustic alkalies. It contains, however, varying quantities of unsaponifiable matter due to the partial breaking up of the acids on distilling the turpentine. The saponifiable matter is mainly abietic acid, $C_{20}H_{40}O_2$. From this formula it follows that 312 parts of abietic acid combine with 56.1 parts of caustic soda, NaOH, to form a neutral sodium rosinate. This will not, however, be the mean combining weight of rosin on account of the contained unsaponifiable matter above mentioned. The mean combining weight of rosin may be taken for practical purposes as 346.

Therefore the proportion of caustic soda to rosin required is very nearly 1 to 6.

Dissolve 30 parts 98% pure caustic soda, or 40 parts of 75% purity in 900 parts of water, heat and gradually add 180 parts rosin. Upon cooling the rosin soap separates from the liquid as a yellow pasty mass. It is drained, and may be put up for use in the soft state, or may be heated to 100° C until it becomes dry and friable when it may be reduced to a powder. In either case the percentage content of rosin should be known if the soap is intended for use as an insecticide. The dry powdered rosin soap is brown and somewhat resembles rosin but is deliquescent and very soluble in water.

Rosin soap can be prepared much more cheaply by this method than on a small scale with washing soda. The Northern Alkali Co. sell rosin soap containing 50% rosin at 15/3 per cwt.

Properties.

Rosin soap in solution in water gives a wash of great wetting power, and of great adhesiveness. On drying, a thin film of the soap remains over the sprayed objects. On exposure to the air, chemical combination with carbon di-oxide sets in with the formation of sodium carbonate and rosin. Any small insects which are thoroughly wetted die from asphyxiation owing to the choking of their spiracles.

Rosin soap is not poisonous to animals, and does not injure foliage unless it contains a considerable excess of caustic alkali. This should be guarded against in commercial preparations. Rosin soap which is intended for insecticides should give a neutral result with litmus paper.

Uses.

Rosin compound is an excellent insecticide for spraying plant lice and other small insects which are not protected by a heavy covering of hairs or of waxy filaments. For aphids and the softer scale insects a strength of one pound of rosin in eight to twelve gallons of wash is sufficient while for the more resistant scale insects one pound to five or six gallons should be used. Green scale, Lecanium viride, on coffee has been successfully treated with a wash of dilution one pound to eight gallons. Keringas,* which are often associated with green scale attack in coffee, causing annoyance by their bites and sometimes considerable loss from the impossibility of gathering the crop of berries, may be substantially reduced in numbers, if not absolutely wiped out, by spraying them heavily when aggregated in their nests of leaves during dull weather or in

* The biting red ant, Oecophylla smaragdina.

the morning and evening. The spraying nozzle should for this purpose be inserted into the nest and a heavy washing be given with rosin compound of strength one pound rosin in six to eight gallons.

In treating scale insects with a contact wash, the best time to apply the wash is upon the emergence of a fresh brood of young nymphs. If the first spraying is not successful in killing out the pest, the appearance of the minute young should be carefully looked for, and when the new generation is in full swing a second thorough spraying should be given. If the moment is well chosen and the spray thoroughly applied, the pest should thus be completely controlled.

In addition to its direct use as a contact poison, rosin compound is valuable as an emulsifier and adhesive. Diluted at the rate of one pound rosin to fifteen gallons, it can be used with lead arseniate, assisting the stomach poison to stick to the foliage. It has also been recommended for use with Paris Green at a dilution of one pound rosin to twenty gallons. Rosin wash should not however be added indiscriminately to stomach poisons, as some soluble metallic salts combine with aqueous solutions of rosin soap to form resinates which may be injurious to plant tissues.

The emulsifying power of rosin soap is extensively applied commercially in the manufacture of sheep dips and of disinfecting fluids containing carbolic acid. Such "Sanitary fluids" when mixed with water form excellent contact poisons.

Rosin—Fish Oil Wash.

Preparation.

Dissolve half a pound of 98% caustic soda, three quarters of a pound of 75%, or a proportionate quantity of lower grade caustic in one gallon of water, boil, and add three pounds of crushed rosin. When the rosin is dissolved add half a pint of fish oil. Stir well, continue boiling, and slowly add cold water until the mixture amounts to three gallons. The liquid should now be thin and of a clear brown colour. Pour a small quantity into a glass of cold water. If no milkiness is produced the preparation is complete. Otherwise boiling must be continued further until the test is answered.

Use.

Rosin-fish oil wash is more powerful than rosin soap, but is employed against the same kinds of insects. It can be used against waxy scales and mealy bugs, but has nothing to recommend it over kerosene emulsion for this purpose. It is, however, very useful against specially resistant scale insects which withstand the application of rosin soap. For this purpose it should be used at a dilution

of one pound of rosin to five gallons of wash.

Kerosene. Petroleum.

It is a matter of common knowledge that kerosene readily kills insects when their bodies are brought into contact with it. The exact nature of the insecticidal action is not, however, fully understood. It acts probably in part by closing the breathing pores, but the rapidity with which death ensues when an insect is thoroughly wetted with kerosene suggests that asphyxiation is not the only or even the most important factor. It is probable that there is a direct poisoning effect due to penetration of the skin or to absorption of kerosene vapour through the air tubes which ramify in the body of the insect.

Undiluted kerosene cannot be used as a spray on plants because it usually kills the green parts and young shoots. For spraying, kerosene must first be made into an emulsion, and can then be used at such a strength as to kill many forms of small insects without damaging the host plants.

The best form of Petroleum emulsions is that which is made with the crude mineral oil. Crude oil emulsion is, however, not an easy insecticide to make with absolute certainty of success. Kerosene emulsion made with refined kerosene as used for burning in lamps, while not so satisfactory an insecticide, is nevertheless a good spray fluid and can readily be made as required.

Kerosene Emulsion.

(*a*). Slice half a pound of bar soap and dissolve in one gallon of hot water. Heat the solution to boiling, take off the fire and rapidly stir into two gallons of kerosene, agitating the mixture by stirring or by passing it through a syringe or sprayer. A creamy mixture should result which mixes readily with water. If free oil separates out and floats on the top, the mixture is not complete.

This is the standard formula for emulsifying kerosene. It forms three gallons of stock solution which can be diluted with cold water as required for use.

In the preparation of all emulsions with soap it is essential to use soft water. Rain water, if obtainable, is the best for the purpose. Should difficulty be experienced either in making stock solution or in spraying on account of hard water, a sample of the water should be submitted to the Agricultural Department for advice.

Use.

Standard kerosene emulsion may be used against aphids, mealy bugs and scale insects which have a waxy protection, against cater-

pillars or other small insects when congregated upon plants, and against mites. It is solely a contact poison and is not poisonous to animals. If used at too great concentration, or if the oil separates out from the emulsion, there is considerable likelihood of damaging the tender parts of plants. Experimental sprayings should therefore be made and the results noted before carrying out work on a large scale.

For use in Malaya, the wash should be diluted to contain from five to eight per cent of kerosene. The higher percentage should never be exceeded for use upon foliage. A useful method for calculating the volume of water required to dilute the standard emulsion to any given percentage is as follows:*—Divide 200 by the required percentage, and subtract 3 from the quotient. This gives the quantity of water necessary to add to 3 gallons of stock solution, to obtain a spray fluid of the required strength. Thus, for a six per cent wash, 200 divided by six gives $33\frac{1}{3}$, subtract 3 and the result $30\frac{1}{3}$ gives the number of gallons of water necessary to add to 3 gallons of stock.

(*b*). Boil together two pounds of soft soap and a gallon of water. When boiling remove from fire and pour into one and a half gallons of kerosene, thoroughly agitating the mixture with a wooden paddle. Continue mixing by passing through a syringe or spraying machine until a uniform creamy emulsion rosults.

This recipe gives a stock solution containing 60% kerosene, which is a slightly lower percentage than that of the previous formula. On account of the insecticidal effect of the soft soap contained which compensates for the lower kerosene content, the above quoted method for calculating the dilution can be applied. The strength of spray fluid and the uses of the wash are the same as in recipe (*a*).

(*c*). A simple method for the preparation of small quantities of kerosene emulsion for use in gardens is as follows:**—Weigh out a pound of soft soap into a pan, and have ready a known quantity of kerosene. Pour kerosene into the pan a teacupful or less at a time. Work the soap and kerosene together through the hands adding more kerosene as the mixture proceeds. When no more kerosene is being taken up by the soap the mixture is ready for dilution. Measure up the remaining kerosene, thus determining the quantity used, and weigh the mixture of soap and kerosene. Mix with water for use at the rate of 20 to 25 parts for each part of kerosene for spraying on leaves, or with 10 to 15 parts for

* Jackson and Wilson. Oregon Agricultural College. Bulletin No. 123.

** I am indebted to Mr. J. Lambourne, F.R.H.S., for this useful recipe.**

applying with a shaving brush to scale insects and mealy bugs on the stems of plants.

Crude Oil Emulsion.

Crude kerosene emulsion is not easy to make, as special appliances are required for mixing. In the absence of such plant, it is best to depend upon commercial preparations. An excellent emulsion containing 80 per cent of crude oil and 20 per cent whale oil soap is made and sold in Calcutta at about seven rupees per five gallon drum. It is diluted for use with from forty-five to ninety volumes of water forming a milky fluid which remains thoroughly emulsified for several days. Preparation of the wash from stock emulsion is effected by measuring the required quantity and mixing with water by hand or with a syringe. It may be necessary to strain the spray fluid before putting into the sprayer.

"Crude Oil Emulsion" is applied as a fine mist. It is effective against all small soft insects except those protected from wetting by hairs or scales. Two applications are usually necessary for such insects as aphids, mealy bugs, thrips and small caterpillars, while for the soft scale insects a third spraying may be necessary. Very hard scaled or hairy insects can better be treated with Rosin Wash than with Crude Oil Emulsion.

Crude Oil Emulsion is harmless to animals and in weak mixture does not damage plants. At a dilution of one in sixty or stronger it should not be used on very tender foliage.

Sanitary Fluids.

In the absence of means of preparation of other contact washes, many disinfectant fluids form useful substitutes. Most sanitary fluids consist of creosote oil, phenol (carbolic acid), or cresol emulsified in a solution of rosin soap. Such fluids on mixing with water, form a milky solution. Against aphids, soft scale insects, mealy bugs and other small insects they give good results at a strength of one part sanitary fluid to one hundred of water. At greater strengths than one in sixty they should be used with great caution as the foliage of plants is likely to be burned. On the woody parts of plants they can however be used at much greater strengths.

AGRICULTURE AT THE BRITISH ASSOCIATION, 1914.

Addresses on agriculture generally devolve, on account of the exceedingly wide range of the subject, into being discourses on certain side-issues, and it is as refreshing and stimulating as it is rare,

to read two such addresses as those delivered by Mr. A. D. Hall, F.R.S., President of the Agricultural Section of the British Association for 1914. Herein Mr. Hall brings to a focus many of the multitudinous by-paths in the maze of investigations, indicating their applications in fields of the widest purview, generalizing with great definiteness, and pointing ideals in method which are likely to have far reaching significance in deciding lines of development.

Mr. Hall delivered two addresses. The first and the former half of the second dealt with the major problems of that aspect of the science dealing with "production" while the latter half of the second dealt with the question of Agricultural Research and Research Institutions in their relation to the State.

The subject of the first lecture was "The winning of land for agriculture," and the following notes are taken therefrom.

The opening up of land in a new country generally results in the exploitation of the better tracts until the time comes, when, this being used up, land of less immediate possibility is taken up, leaving the remainder to await times of pressure for its opening. This is perhaps particularly noticeable in the case of the United States of America. Here the middle and western areas of fertile land, land which had accumulated reserves of vegetable wealth, were soon used up, with the result that the increasing population dictated a wider choice being made in land of less value—land less amenable to Agriculture.

The effect of opening up new land is not without its effect—transient though it may often be—on well established agriculture. In the eighties and nineties of the last century the opening up of the wheat tracts of America, Argentine and Australia had the effect of making wheat-growing in certain parts of England unprofitable, with the result that pasture took the place of the previously established wheat-farms. But population, a factor of slow but ever increasing magnitude had the effect of recasting the distribution of wheat-areas, with the result that these latter lands became re-exploited for the service they bore prior to the change.

Now waste land is waste capital, and within fifty miles of our metropolis there are thousands of acres of "waste land." Such may also be found in Belgium and Holland, but the pioneer in the attempt to realize this source of wealth is Germany, who with ten millions of acres of land hitherto run to waste, has made organized effort to reclaim it, and so increase her food production. It is clear that there are two aspects to this question of increased production—two aspects of method whereby it, the finale of all agricultural work may be attained: the one is that new and waste land be opened up, and the other is, that we may, by putting our house in order in the direction of

improved method, make our present areas yield the more. It is to be noted however that this latter method is a slow business, whose speed is limited by the rate of increase of scientific knowledge, itself a fund of but slow accumulation, and though there is a potent necessity that this latter should be developed, there is the need that the other process should go with it hand in hand.

In analysing the factors which make for cultivatibility and fertility Mr. Hall emphasizes *rainfall in distribution and amount,* and this in relation to *temperature.* As concerns this group of factors it is a matter of experience that excessive rainfall and inadequate drainage make a combination which produce almost maximum infertility. We have examples of large dimensions in our own country in the bogs of Ireland and the moors of East England. (Many similar large areas in this country are also to be found).

Next to this comes *texture,* and the large areas of heath and general waste land of Western Europe are such because of their open and coarse texture and inadequate water supply.

Finally, and this with a vital importance to fertility is the importance of lime.

"Pliny reports it as prevailing in Gaul and Britain in his day, and the farmer of to-day often owes the value of land to his unknown predecessors who continuously chalked or marled the land."

Without this the all important Nitrogen fixing organisms cannot work. This has been proved in the laboratory—it is unquestionably proven in field and soil-work generally. The famous *black-soils,* known for their extreme fertility, and occuring in various parts of the world are all decidedly calciferous, and it has been demonstrated that their degree of fertility runs more or less parallel with their lime content. The distribution of these soils is local yet world-wide: they occur in regions of medium rainfall such as induce grass-steppe or bush conditions and are all calcareous, satisfying conditions for the working of Azotobacter sp. as compared with the similar but non-calcareous soils unable to accumulate a nitrogen reserve, lacking the nitrogen fixing power found in these organisms. Of all soil factors making for soil fertility Mr. Hall puts Lime first. It is the deciding factor for the growth of Nitrogen fixers; it is the factor which is most easily altered at the hands of the operator.

But how can lands suffering from these various drawbacks indicated above be claimed for agriculture?

The extension of cropping into regions of deficient rainfall is perhaps best done by dry-farming, a method of husbandry as old

as Jethro Tull. The methods need perhaps no note except that there is an innovation on the part of the settlers in Australia and North America to give a year fallow, solely for water accumulation for the ensuing crop. Here, if in any method of agriculture, there is the necessity to know what are the precise requirements of water for any ordinary crop. Experiments have been made in this direction and it has been estimated that 500 tons of water per annum is required for the production of a crop of wheat of 20 bushels per acre. This amount is actually used by the crop itself and from additional data it is stated that under certain conditions of culture which Mr. Hall indicates, cereals can after winter rain be grown profitably with an annual rainfall of twelve inches.

Closely linked with the question of requisite water supply are the problems which arise from areas suffering from saline water. The history of agriculture of these areas is full of instances of attempt and failure but the need for this is no more—proper irrigation combined with drainage will meet the case.

As concerns land in North Western Europe two types present themselves—the one the peaty tracts with their excess of water, their low mineral content and their potential wealth of nitrogen, and the other, the coarse unretentive sandy areas. Of the former there have been reclaimed in Germany some ten thousand acres mainly by drainage and keeping the water table below a three feet level subsequently sanding the soil, prior to manuring with lime, basic slag and kainit after the removal of the peat. The whole secret of the process is the drainage and manuring.

It is more especially as concerns the Heaths that people in England are concerned. The method of reclamation is that the land is first burnt of its shrub, then shallowly turned over in the summer, leaving the soil to the action of the sun and the subsequent disintegration by frost in the winter; after this, lime, basic slag and kainit are added—the whole being worked up into a seed-bed wherein lupins are sown and ploughed in, in flowering stage. *The lupins make the land.*

Now adoption of new methods particularly if they be arduous even though they may be prompted by keen competition will be decided upon in their relation to pounds, shillings and pence, and what has happened in Germany in this direction will not necessarily be possible in England where the nature of man is different, where wages are higher and where agricultural prices are lower. Be this as it may, Mr. Hall is convinced that reclamation of land of this nature is not only more and more possible than heretofore but that it is a sound commercial undertaking, thanks to agricultural science pointing the way. G. E. C.

FEDERATED MALAY STATES.

Comparative Statement of Cultivated Rubber Exported, with Value and Duty Collected Thereon, During the Years 1915 and 1914.

Destination.	Exported during July, 1915.	Previously.	Total export during the year.	Export during similar period of previous year.	Increase.	Decrease.	Value of rubber exported, 1915.	Duty collected, 1915, to date.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	$	$ c.
Straits Settlements ..	2,440.09	12,529.20	14,969 29	10,052.02	4,917.27	...	29,697,082	
United Kingdom ...	1,170.12	6,231.69	7,401.81	5,433 65	1,968.16	...	14,628,097	
Continent of Europe ..	...	8.00	8.00	801.78	...	793.78	15,880	
Ceylon	76.56	326.29	402.85	433.48	...	30.63	794,895	
Other Countries ...	...	95.07	95.07	100.27	...	5.20	181,447	
Total ...	3,686.77	19,190.25	22,877.02	16,821.20	6,885.43	829.61	45,317,401	1,172,698 10

KUALA LUMPUR,
6th August, 1915.

F. J. WELD,
Acting Commissioner, Trade and Customs, F.M.S.

Abstract of Meteorological Readings in the various Districts of Malaya for the month of July, 1915.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	TEMPERATURE.				HYGROMETER.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
Kelantan, Kota Bahru ...	...	132.2	83.2	92 12	74.64	17.48	78.4	.874	75.2	77.	...	7.08	1.60
Pahang, Kuala Lipis ...	...	...	80.3	91 4	77.1	14.0	75.6	...	...	...	...	8.11	1.55
Johore, Johore Bahru ...	...	...	...	87.06	73.40	13.66	...	...	...	...	...	8.72	...
Singapore, Kandang Kerbau	29.802	158.0	82.8	87.6	75.1	12.5	78.3	.903	...	82.	...	8.44	1.96
Malacca, Durian Daun ...	29.791	147.8	82.0	87.8	70.2	17.6	79.5	.966	...	87.	N.W.	17.98	4.60
Negri Sembilan, Seremban ..		153.8	77.0	87.	72.7	14.3	75.	.831	74.5	83.8	N.W.	9.38	2.56
,, Kuala Pilah ...	...	152 8	80.9	90.8	72.9	17.9	78.9	.940	77.9	89.8	...	3.05	.70
,, Port Dickson	...	129.7	82.1	88.7	74.5	14.2	77.6	.860	74.0	78.7	...	9.04	3.11
Selangor, Kuala Lumpur ...	29.805	144.7	80.4	88.9	77.6	11.3	77.9	.904	76.1	86.	S.E.	5.70	1.65
,, Klang ...	...	...	81.4	86.6	74.3	12.3	76.9	...	...	...	...	10.99	2.33
,, Kuala Selangor ...	...	..	...	88.9	75.1	13.8	...	...	...	...	...	6.15	1.85
,, Rawang ...	...	...	...	91.1	74.0	17.1	...	...	...	...	...	14.09	2.71
Perak, Telok Anson ...	...	...	82.70	93.	72.	21.	78.04	.899	...	81.	...	8.98	4.10
,, Ipoh ...	...	...	82.86	93.	72.	21.	77.39	.850	...	79.	...	12.16	2.30
,, Taiping ...	...	...	82.84	93.	72.	21.	77.71	.861	...	79	...	14.56	4.12
,, The Cottage ...	...	...	...	...	...	...	...	...	...	...	...	16.54	6.00
,, Parit Buntar ...	...	...	83.58	93.	72.	21.	78.55	.893	...	79.	...	5.51	2.24
Penang, Georgetown ...	29.796	141.7	82.9	89.1	74.5	14.6	78.1	.893	75.0	79.	...	8.57	2.65
Kedah, Alor Star ...	...	...	...	...	...	...	...	...	...	...	...	9.19	...
Perlis, Perlis ...	...	...	...	...	...	...	...	...	...	...	...	6.03	...